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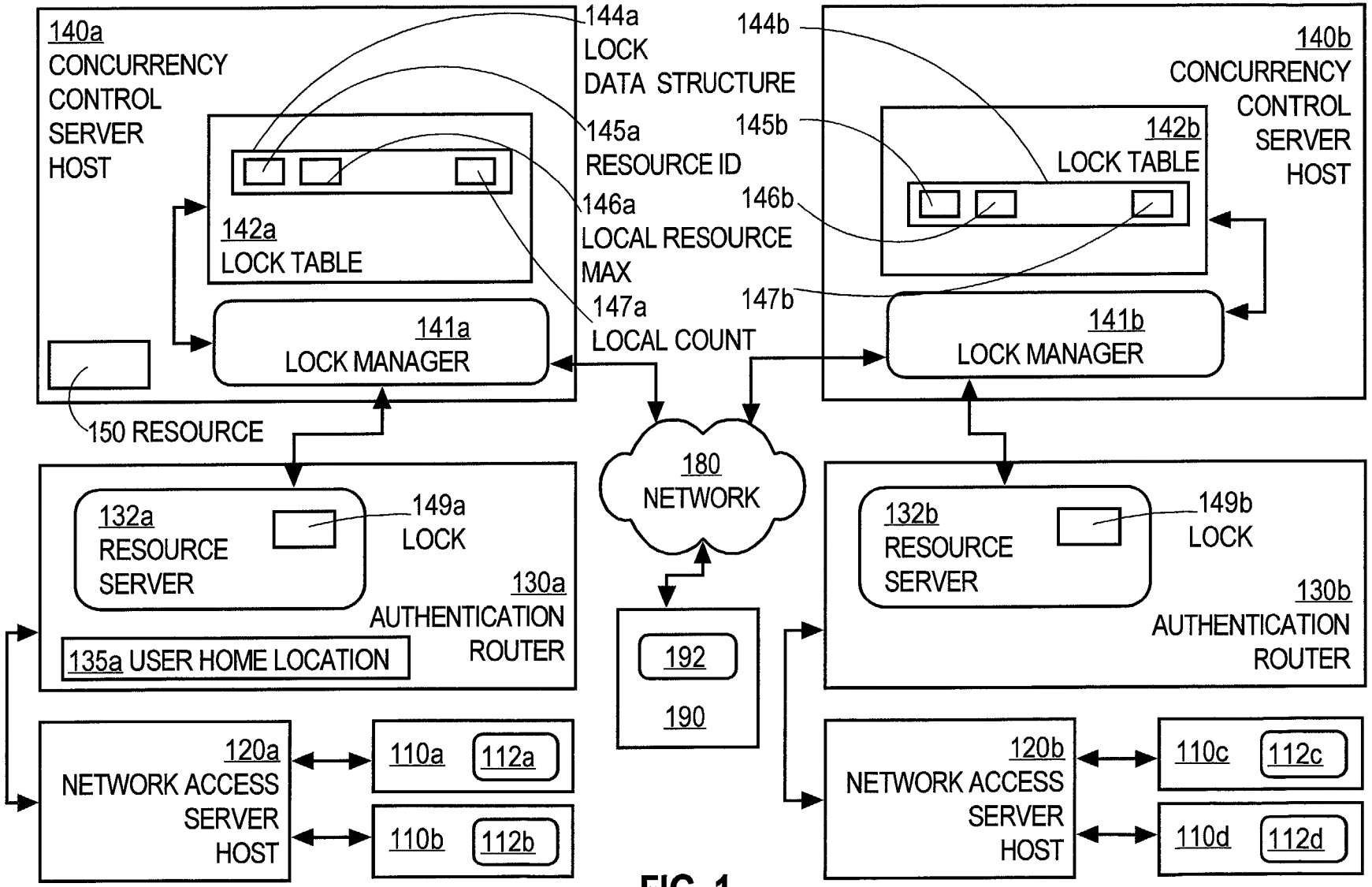

FIG. 1

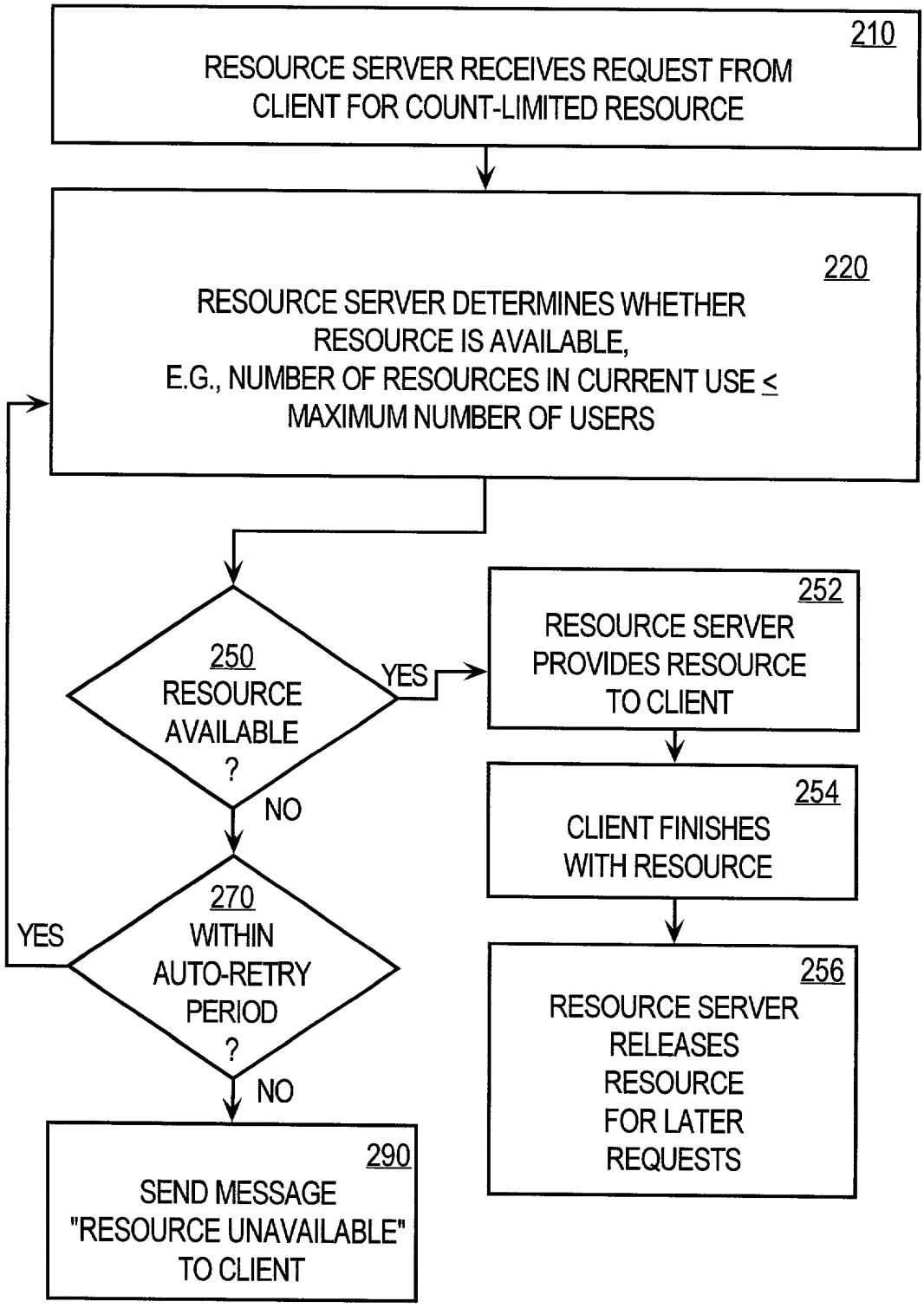
210
RESOURCE SERVER RECEIVES REQUEST FROM CLIENT FOR COUNT-LIMITED RESOURCE
220
RESOURCE SERVER DETERMINES WHETHER RESOURCE IS AVAILABLE, E.G., NUMBER OF RESOURCES IN CURRENT USE ≤ MAXIMUM NUMBER OF USERS
250
RESOURCE AVAILABLE ?
YES
NO
252
RESOURCE SERVER PROVIDES RESOURCE TO CLIENT
254
CLIENT FINISHES WITH RESOURCE
256
RESOURCE SERVER RELEASES RESOURCE FOR LATER REQUESTS
270
WITHIN AUTO-RETRY PERIOD ?
YES
NO
290
SEND MESSAGE "RESOURCE UNAVAILABLE" TO CLIENT

FIG. 2A

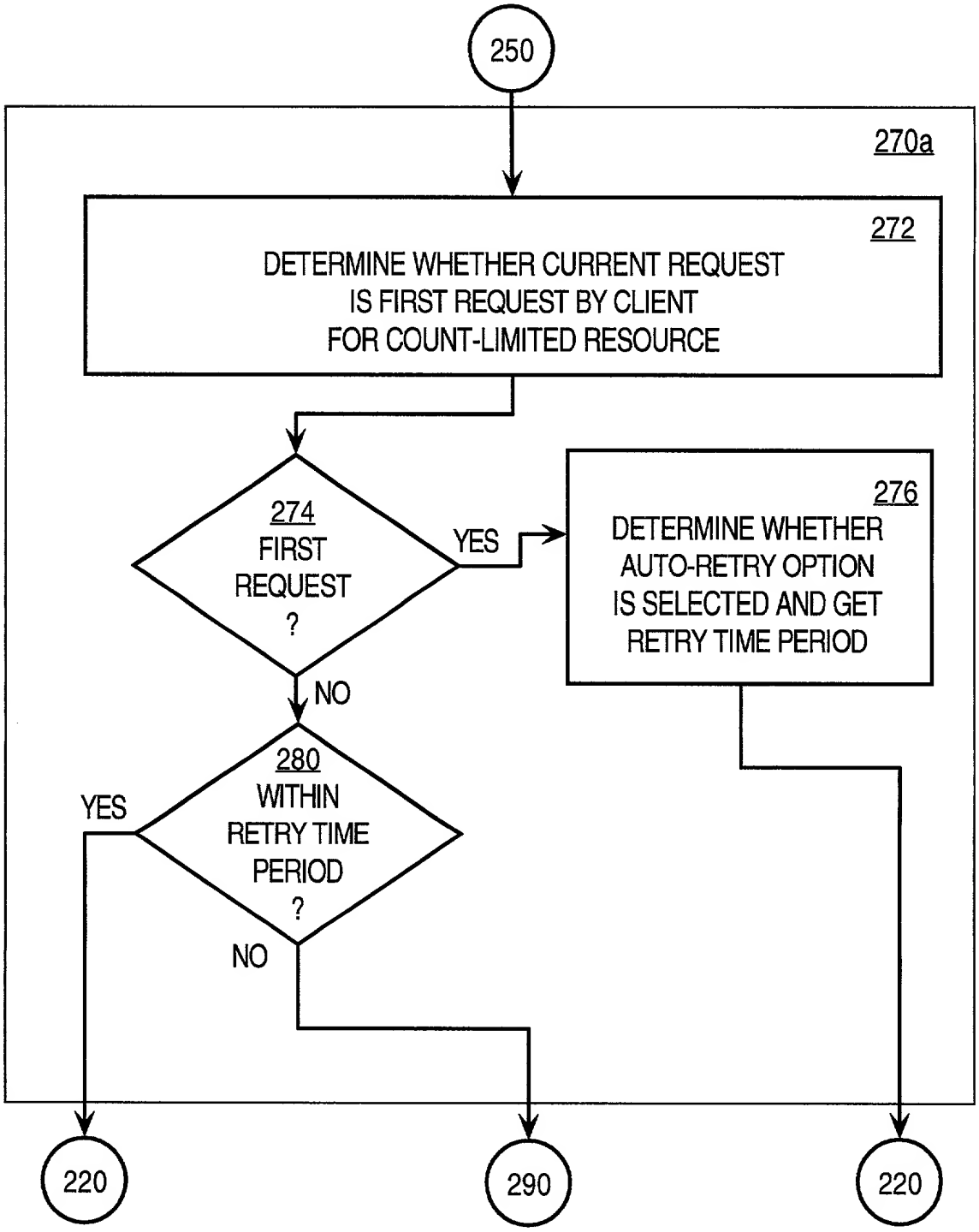
250
270a
272
DETERMINE WHETHER CURRENT REQUEST
IS FIRST REQUEST BY CLIENT
FOR COUNT-LIMITED RESOURCE
274
FIRST
REQUEST
?
YES
276
DETERMINE WHETHER
AUTO-RETRY OPTION
IS SELECTED AND GET
RETRY TIME PERIOD
NO
280
WITHIN
RETRY TIME
PERIOD
?
YES
NO
220
290
220

FIG. 2B

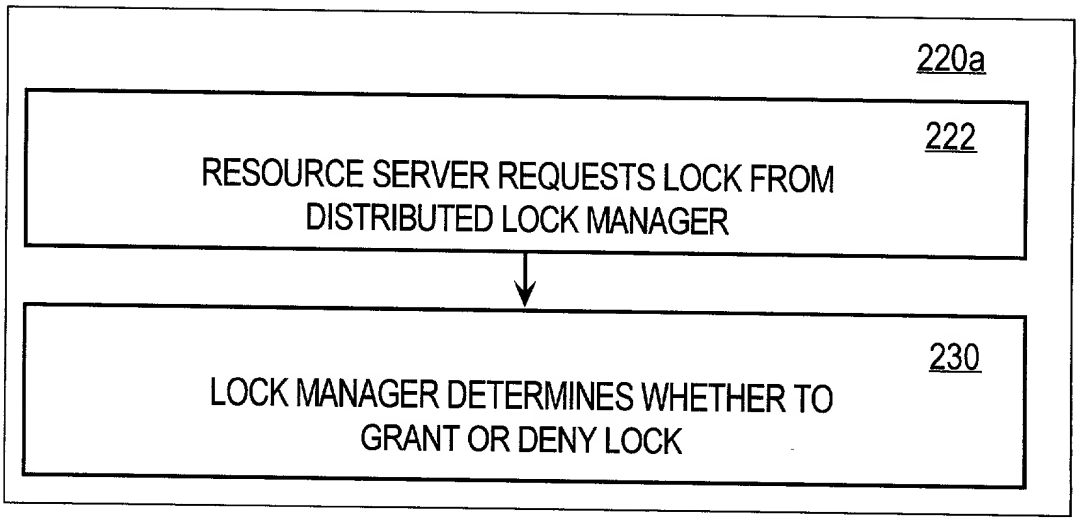
220a
222
RESOURCE SERVER REQUESTS LOCK FROM DISTRIBUTED LOCK MANAGER
230
LOCK MANAGER DETERMINES WHETHER TO GRANT OR DENY LOCK

FIG. 2C

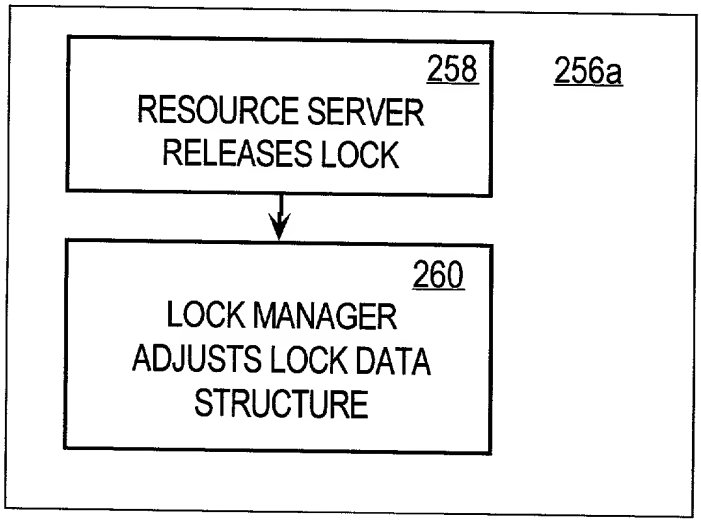
258
RESOURCE SERVER RELEASES LOCK
256a
260
LOCK MANAGER ADJUSTS LOCK DATA STRUCTURE

FIG. 2D

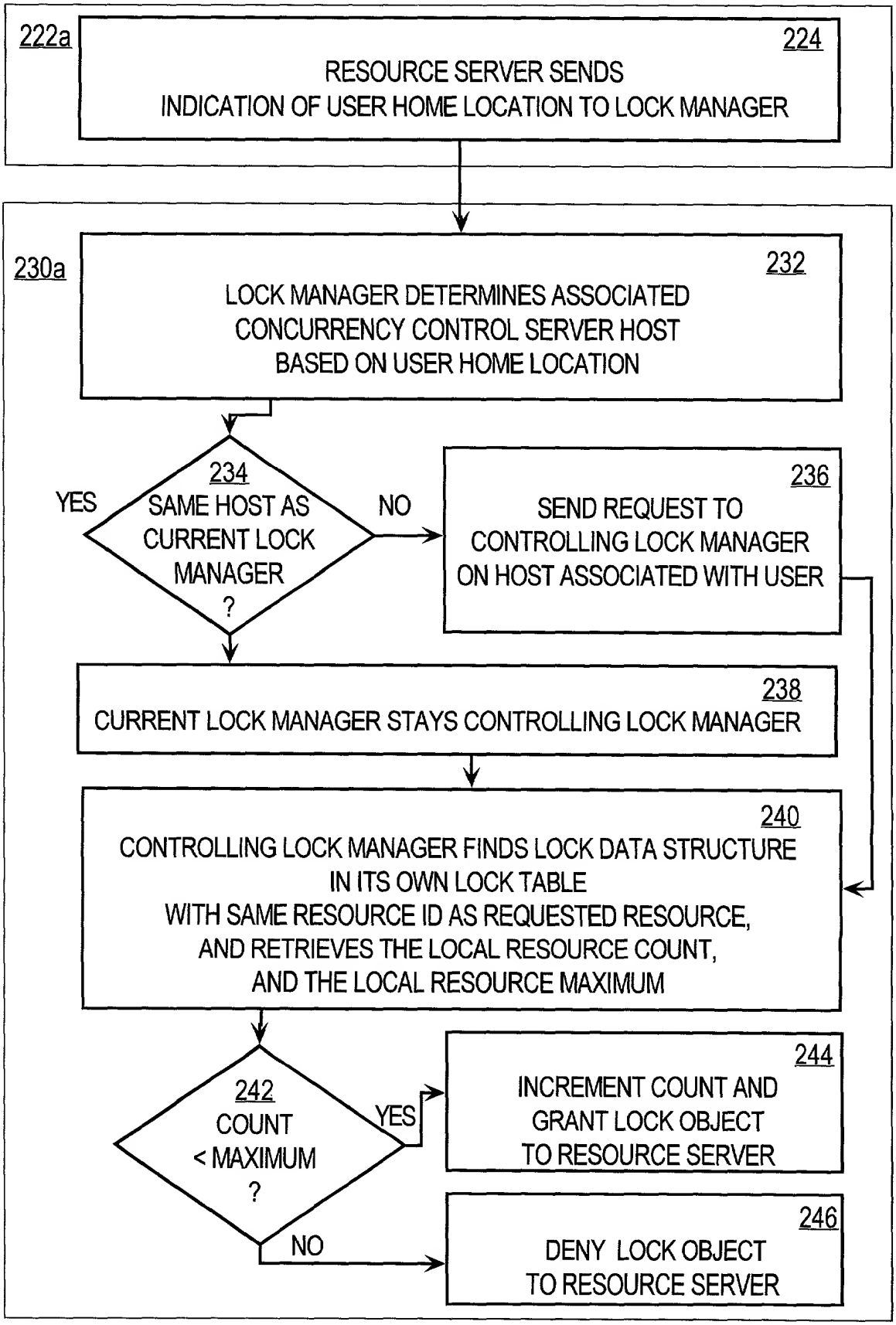
222a
224
RESOURCE SERVER SENDS
INDICATION OF USER HOME LOCATION TO LOCK MANAGER
230a
232
LOCK MANAGER DETERMINES ASSOCIATED
CONCURRENCY CONTROL SERVER HOST
BASED ON USER HOME LOCATION
234
SAME HOST AS
CURRENT LOCK
MANAGER
?
YES
NO
236
SEND REQUEST TO
CONTROLLING LOCK MANAGER
ON HOST ASSOCIATED WITH USER
238
CURRENT LOCK MANAGER STAYS CONTROLLING LOCK MANAGER
240
CONTROLLING LOCK MANAGER FINDS LOCK DATA STRUCTURE
IN ITS OWN LOCK TABLE
WITH SAME RESOURCE ID AS REQUESTED RESOURCE,
AND RETRIEVES THE LOCAL RESOURCE COUNT,
AND THE LOCAL RESOURCE MAXIMUM
242
COUNT
< MAXIMUM
?
YES
NO
244
INCREMENT COUNT AND
GRANT LOCK OBJECT
TO RESOURCE SERVER
246
DENY LOCK OBJECT
TO RESOURCE SERVER

FIG. 2E

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330

TO BALANCE NETWORK TRAFFIC ON HOSTS,
LOAD BALANCER INCREMENTS RESOURCE MAXIMUM
ON ONE HOST AND DECREMENTS RESOURCE MAXIMUM
ON ANOTHER HOST
KEEPING CONSTANT AGGREGATE OF ALL MAXIMA
FOR EACH PARTICULAR RESOURCE

FIG. 3A

330a

331

ON REGULAR SCHEDULE, LOAD BALANCER
DECREMENTS RESOURCE MAXIMUM ON ONE HOST
AND INCREMENTS RESOURCE MAXIMUM ON ANOTHER HOST

FIG. 3B

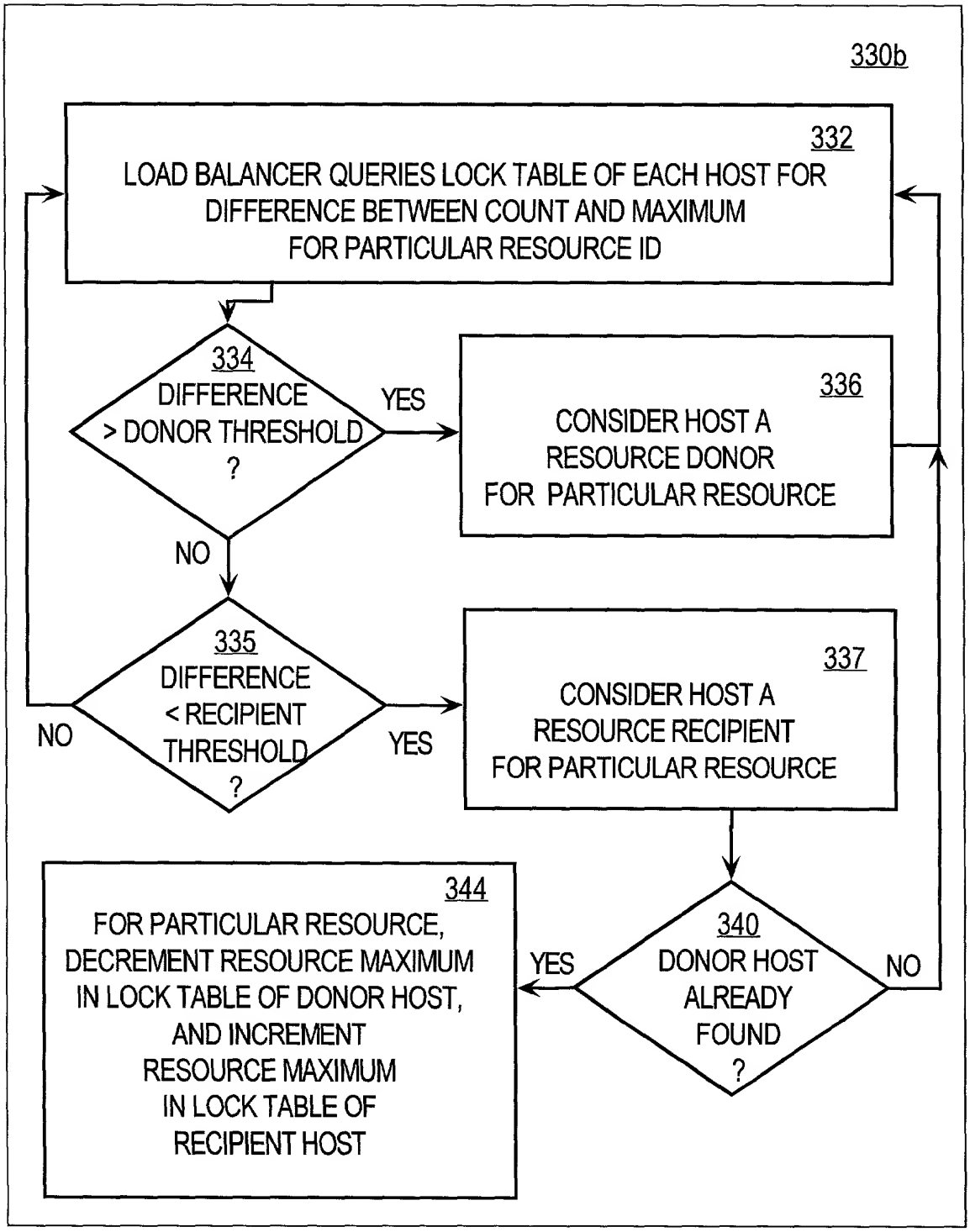
330b
332
LOAD BALANCER QUERIES LOCK TABLE OF EACH HOST FOR DIFFERENCE BETWEEN COUNT AND MAXIMUM FOR PARTICULAR RESOURCE ID
334
DIFFERENCE > DONOR THRESHOLD ?
YES
336
CONSIDER HOST A RESOURCE DONOR FOR PARTICULAR RESOURCE
NO
335
DIFFERENCE < RECIPIENT THRESHOLD ?
NO
YES
337
CONSIDER HOST A RESOURCE RECIPIENT FOR PARTICULAR RESOURCE
340
DONOR HOST ALREADY FOUND ?
YES
NO
344
FOR PARTICULAR RESOURCE, DECREMENT RESOURCE MAXIMUM IN LOCK TABLE OF DONOR HOST, AND INCREMENT RESOURCE MAXIMUM IN LOCK TABLE OF RECIPIENT HOST

FIG. 3C

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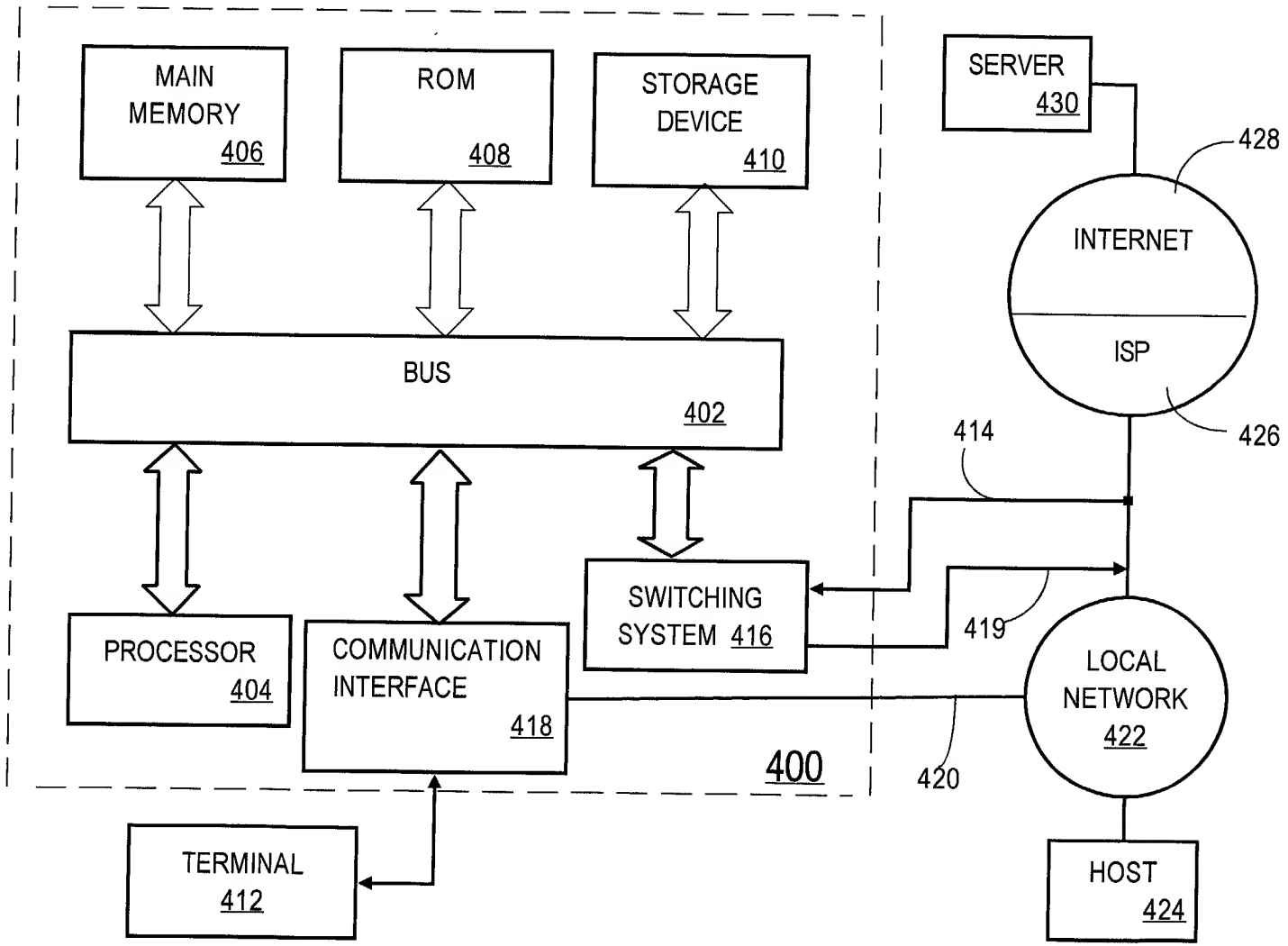
FIG. 4